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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/052,347	01/23/2002	Katsuhide Manabe	P 282475	4113
	7590		F00-219-USdiv3-c	
	12/29/2003		EXAMINER	
			MULPURI, SAVITRI	
			ART UNIT	PAPER NUMBER
			2812	
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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.
10/052,347

Applicant(s)
Manabe et al

Examiner
Savitri Mulpuri

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on amdt filed on 3/19/03.
- 2a) ☒ This action is FINAL. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 19-52 and 119-127 is/are pending in the application.
- 4a) Of the above, claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 19-52 and 119-127 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claims _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
*See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s). 5 6) ☐ Other: _____

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DETAILED ACTION

This action is in response to the applicant's amendment to claims filed on 3/19/03

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless -

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 19-36, 119-121 are rejected under 35 U.S.C. 102(b) as being anticipated by Sayyah et al (Published in Journal of Crystal growth 77 (1986) pp 424-429)

Sayyah et al discloses a method of growing GaN or AlGa_N on sapphire substrate by vapor phase epitaxy MOCVD, HCVD: Sayyah further discloses growing AlN layer in addition AlGa_N and GaN layers, by using silane and with TMG, TMA, and ammonia. Sayyah et al discloses flow rate of silane is 10-1200 SCCM to obtain donor concentration of $9 \times 10^{18}/\text{cm}^3$. Since silicon is shallow donor in GaN, the claimed electron concentration is close to that of disclosed silicon concentration of Prior art in the GaN material. In the prior art the measured silicon concentration was limited by the detect ability limit of the technique used to measure the silicon concentration. Based upon the range of flow rates of silane used in the prior art, it is conceivable that a wide range of silicon concentration spanning more than three decades variation has been achieved in the prior art. Sayyah et al do not explicitly teach conductivity. However, the above dopant silicon concentration in the prior art cover the claimed ranges of conductivity.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior

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art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 37-52, 122-127 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sayyah et al . Sayyah et al does teach individual epitaxial layer of AlGa_N , Ga_N, Al_N, but does not teach using one of the layers as buffer layer. It is well known that using one of the above mentioned layers as buffer layer to reduce crystal defects in the active layers used for device.

Applicant's arguments filed on 3/19/03 have been fully considered but they are not persuasive. Applicant contends that the inventive method includes setting a mixing ratio of silicon-containing gas to at least one of the raw material gas at a desired value in a range over which a conductivity of the gallium nitride group compound semiconductor increases substantially proportionally with mixing ratio. So as to obtain conductivity of the gallium nitride group compound semiconductor , and forming the gallium nitride group semiconductor by feeding the silicon -containing gas and at least one other raw material gas at the mixing ratio.

Applicant argues that Sayyah does not teach a method of fro producing gallium nitride group compound semiconductor by an organometallic compound vapor phase epitaxy, wherein the method includes setting a mixing ratio of silicon-containing gas to at least one of the raw material gas at a desired value in a range over which a conductivity of the gallium nitride group compound semiconductor increases substantially proportionally with mixing ratio. So as to obtain conductivity of the gallium nitride group compound semiconductor , and forming the gallium nitride group semiconductor by feeding the silicon -containing gas and at least one other

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raw material gas at the mixing ratio. However Sayyah et al teaches metal-organic precursors e.g., trimethylgallium (TMG) or trimethylaluminum (TMA) and ammonia for growing gallium nitride based compound semiconductor(see introduction).

Applicant repeatedly argues over one issue, which is Sayyah does not teach setting mixing ratio of silicon -containing gas to at least one other raw material gas at a desired value in the range over which a conductivity/carrier concentration increases substantially proportionally with mixing ratio. However, Sayyah discloses silicon doping by using silane to control the conductivity of GaN based compound semiconductor. Sayyah also discloses silicon in GaN based semiconductor has shallow donor level (see page 428, section 3.2 and fig. 5).

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THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR

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1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to S. Mulpuri whose telephone number is 703-272-1677. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.



SAVITRI MULPURI
PRIMARY EXAMINER